

Cátia Teixeira ¹
Vasco Cadavez ^{1,2}
Fernando C. Monteiro ¹

¹ IPB - Polytechnic Institute of Bragança, Portugal
² CIMO - Mountain Research Center

ABSTRACT

The accurate segmentation of beef-marbling images plays an important role in making the correct decision on beef-marbling score in an automatic beef quality grading system. The purpose of this study is to develop a new segmentation method to correctly separate the fat flecks from the muscle in the rib-eye region of beef images.

CONCLUSIONS

Image processing methods such as grey-scale transformation, contrast enlargement, morphological operations and binary segmentation, were used to process the image to effectively extract the rib-eye area of the beef.

From the experimental results it has been confirmed that the proposed system enables high quality grading of beef marbling and robust region segmentation of the actual beef rib-eye image into lean and fat regions.

REFERENCES

- K. Chen and C. Qin. Segmentation of beef marbling based on vision threshold. *Computers and Electronics in Agriculture*, 62(2):223-230, 2008.
- W. Cheng, J.-H. Cheng, D.-W. Sun and H. Pu. Marbling analysis for evaluating meat quality: Methods and techniques. *Comprehensive Reviews in Food Science and Food Safety*, 14(5):523-535, 2015.
- P. Jackman, D.-W. Sun, C.-J. Du and P. Allen. Prediction of beef eating qualities from colour, marbling and wavelet surface texture features using homogenous carcass treatment. *Pattern Recognition*, 42(5):751-763, 2009.
- P. Jackman, D.-W. Sun, P. Allen. Prediction of beef palatability from colour, marbling and surface texture features of longissimus dorsi. *Journal of Food Engineering*, 96(1):151-165, 2010.
- B. Pang, X. Sun, K. Chen. A fast beef marbling segmentation algorithm based on image resampling. *TELKOMNIKA Indonesian Journal of Electrical Engineering*, 12(5):3894-3901, 2014.
- J. Subbiah, N. Ray, G. A. Kranzler, and T. Acton. Computer vision segmentation of the longissimus dorsi for beef quality grading. *Transactions of the ASAE*, 47(4):1261-1268, 2004.
- J. Tan. Meat quality evaluation by computer vision. *Journal of Food Engineering*, 61(1):27-35, 2004.

CORRESPONDING AUTHOR

Fernando C. Monteiro
 E-mail: monteiro@ipb.pt
 Tel. (+351) 273 303 012
 www.estig.ipb.pt

RECPAD 2015

Introduction

The existing methods for meat quality classification rely heavily on visual evaluation of certain characteristics of the carcasses according to the United States Department of Agriculture beef quality grading system. The features of longissimus dorsi (LD) are colour, marbling and surface texture which can be used to generate predictive models of eating quality parameter. For current standards of grading beef quality, the beef marbling score is assigned from visual appraisal of the LD muscle.



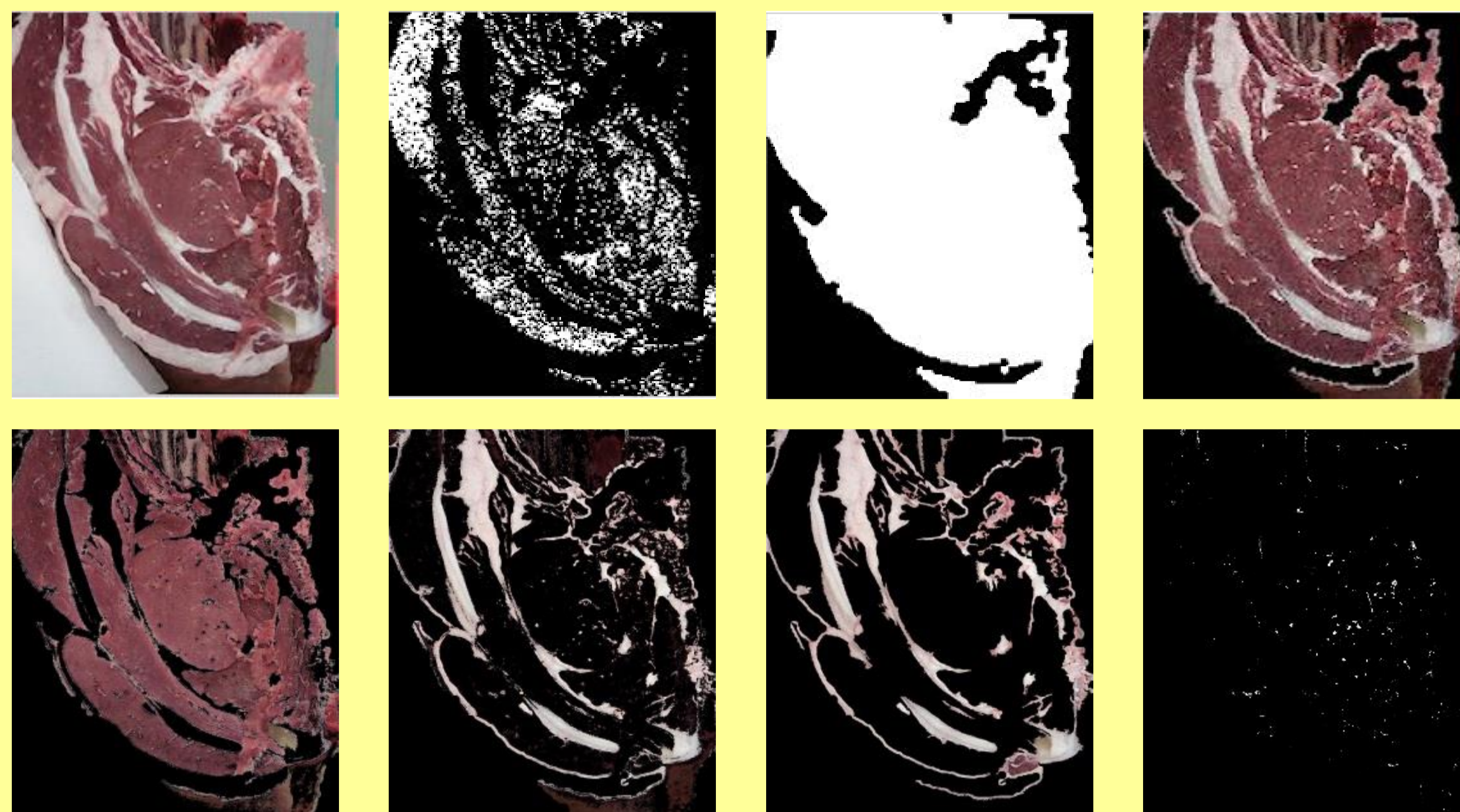
In this work we propose a computer vision framework that can be used in beef quality evaluation. The key idea is to measure the percentage of marbling in the muscle.

Proposed Method

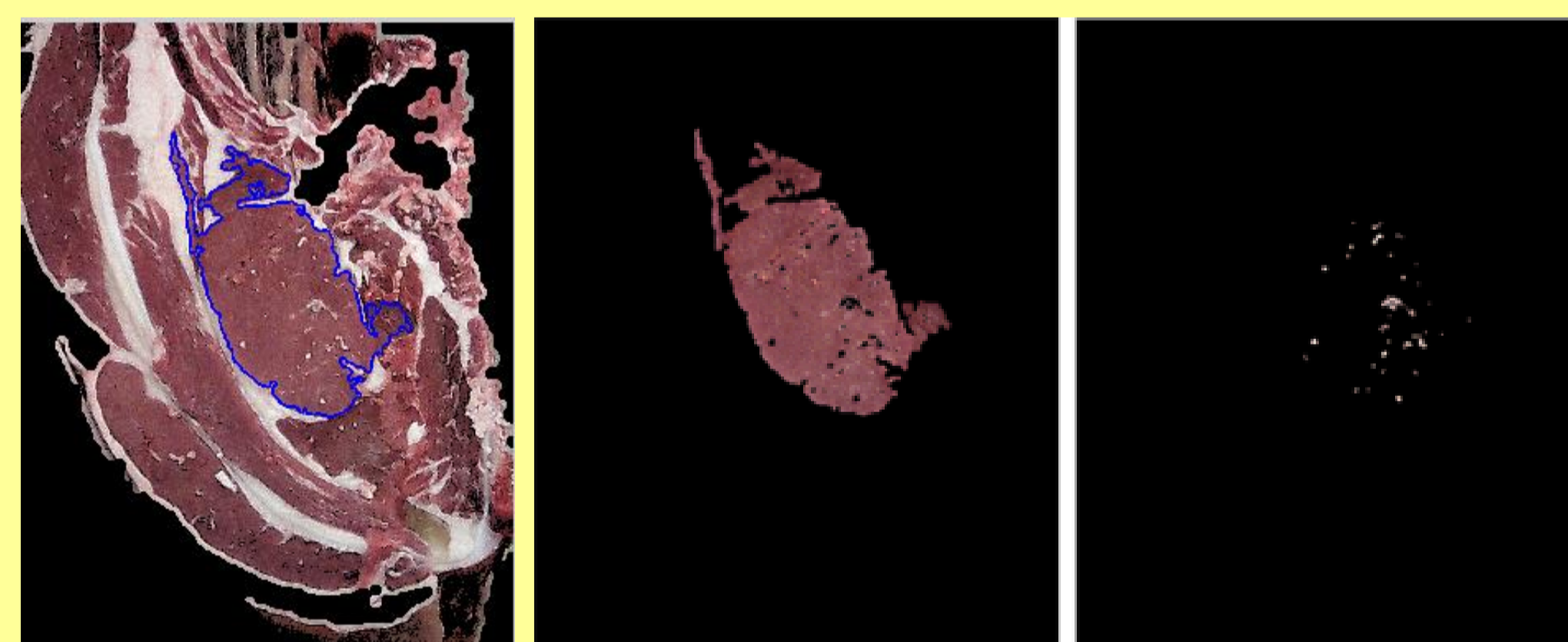
The image pre-processing refers to the operation separating the rib-eye from the background. First, we used the Lab colour space to calibrate the brightness of the images. In order to extract the background we use an optimal linear combination of the RGB colour components with a threshold technique.

We applied morphological operations to correct the marbling regions. We began with a close operation with a disk of 10 followed by a hole filling operation obtaining the region of interest.

After the segmentation of the region of interest area, the next step was to achieve the segmentation of the beef, in order to separate the muscle without marbling from the total fat existing on the piece of meat.



Results and Discussion



Muscle	Marbling
98.12%	1.88%



Muscle	Marbling
99.12%	0.88%



Muscle	Marbling
98.93%	1.07%

We conducted our experiments using the proposed segmentation algorithm on 83 sample images. Although the algorithm produce good results in most of the images in some of them it gives higher marbling percentage than it really exists in the beef. A reasonable explanation for that is the moisture on the surface of beef rib-eye which will cause reflection of light under a good lighting condition affecting to a degree the image segmentation of marbling.